



## Field Trip to the Moon

### DESCRIPTION

Students explore the Moon's habitability and sustainable resources with activities that culminate with plans for the design and creation of a lunar station.

### OBJECTIVES

Students will

- Utilize an inquiry-based learning approach that fosters team building and introduces students to careers in science and engineering
- Develop their cooperative learning skills to design a self-sufficient lunar station

### NASA SUMMER OF INNOVATION UNIT

*Life Science—Survival*

### GRADE LEVELS

4 – 6

### CONNECTION TO CURRICULUM

*Science, Technology, Engineering, and Mathematics*

### TEACHER PREPARATION TIME

2 hours

### LESSON TIME NEEDED

4 hours

*Complexity: Moderate*

## NATIONAL STANDARDS

### National Science Education Standards

#### *Science as Inquiry*

- Understanding of scientific concepts
- Abilities necessary to do scientific inquiry
- Skills necessary to become independent inquirers about the natural world
- The dispositions to use the skills, abilities, and attitudes associated with science

#### *Life Science*

- Characteristics of organisms
- Organisms and environments
- Structure and function in living systems
- Populations and ecosystems
- Diversity and adaptations of organisms

#### *Earth and Space Science*

- Structure of the Earth system

#### *Science and Technology*

- Abilities to distinguish between natural objects and objects made by humans
- Abilities of technological design

#### *Science in Personal and Social Perspectives*

- Personal health
- Types of resources
- Changes in environments
- Populations, resources, and environments
- Natural hazards
- Risks and benefits
- Science and technology in society

### Technology Education Performance Indicators for Students

#### *Creativity and Innovation*

- Apply existing knowledge to generate new ideas, products, or processes
- Use models and simulations to explore complex systems and issues

#### *Research and Information Fluency*

- Process data and report results
- Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media

### *Critical Thinking, Problem Solving, and Decision Making*

- Identify and define authentic problems and significant questions for investigation
- Plan and manage activities to develop a solution or complete a project
- Collect and analyze data to identify solutions and/or make informed decisions
- Use multiple processes and diverse perspectives to explore alternative solutions

### *Technology Operations and Concepts*

- Understand and use technology systems
- Select and use applications effectively and productively
- Transfer current knowledge to learning of new technologies

## MANAGEMENT

Gather all materials listed in the guide or purchase the NASA Kit (<http://corecatalog.nasa.gov/mediatype.cfm?media=1>) as needed. Using medium-sized cardboard boxes, create a toolbox for each team. In addition to placing and sorting materials into each toolbox, you will also need time to cut out the task, data, and other items from the reproducible.

## CONTENT RESEARCH

Field Trip to the Moon is a special program developed by NASA. It will take them on a virtual mission to the Moon. On their journey they will discover some of the differences between Earth and the Moon and what makes our planet unique and habitable. They will continue their mission by working in teams to design a permanent, self-sustaining lunar station where humans can live and work. During the investigation, students will also learn about some of the many careers needed to establish a successful lunar habitat.

A common misconception students may have about the Moon is that it has an atmosphere and no gravity. Be sure to clarify that it has no atmosphere and only 1/6<sup>th</sup> the gravity found here on Earth.

The lesson is divided into six sections or investigations. Each section contains content information to guide the students in their investigations.

## MATERIALS

*(Basic materials are listed. Complete list can be found on pages 12–13 in the guide)*

- Large pieces of paper
- Drawing materials
- Scissors
- Glue sticks or tape
- Rulers
- Handheld magnifying glasses
- Large envelopes

### Key Concepts:

- The Moon and Earth have very different environments.
- Earth contains all the elements in its environment necessary for life: water, food, air, energy, radiation protection, and shelter.
- Establishing a permanent human habitat on the Moon requires complex engineering design and construction procedures.
- Many different people with many different backgrounds and careers will be needed to establish a permanent habitat on the Moon.

### Key Terms:

- **Ecosystem:** a biological community of interacting organisms and their physical environment
- **Engineering:** the branch of science and technology concerned with the design, building, and use of engines, machines, and structures
- **Geology:** the science that deals with the Earth's physical structure and substance, its history, and the processes that act on it
- **Habitat:** the natural home or environment of an animal, plant, or other organism
- **Medical:** the science or practice of medicine
- **Navigation:** the process or activity of accurately ascertaining one's position and planning and following a route

## LESSON ACTIVITIES

The *Field Trip to the Moon* curriculum guide is divided into six investigations that are described below.

### Ecosystem Investigation

This team will investigate ecosystems and food webs. Using the information they gather, they will design a

sustainable ecosystem for the lunar station.

### **Geology Investigation**

This investigation locates and analyzes resources at the chosen landing site. The student teams will then determine the natural resources available and select a mining area.

### **Habitat Investigation**

This investigation identifies the living, working, and recreational space needed for humans on the Moon. The student teams will then design a model of a sustainable habitat for humans.

### **Engineering Investigation**

This investigation determines the energy resources available on the Moon and design a power station for the lunar station.

### **Navigation Investigation**

This investigation chooses one of two possible landing sites on the Moon. The students will then pack the rocket so that all the needed materials from each team will fit in the cargo bay.

### **Medical Investigation**

This investigation explores various types of emergencies that may occur on the Moon and select the medical equipment that would be best suited for responding to those emergencies.

The complete *Field Trip to the Moon* curriculum guide can be found at

[Field Trip to the Moon - Educator Guide](#)

## **ADDITIONAL RESOURCES**

*Field Trip to the Moon* companion guide

[Companion Guide](#)

*Field Trip to the Moon*: LRO/LCROSS Edition Informal Educator Guide

[LRO/LCROSS Edition](#)

Apollo 40<sup>th</sup> anniversary

<http://www.nasa.gov/externalflash/apollo40/>

LRO/LCROSS mission page

<http://lcross.arc.nasa.gov/>

## **DISCUSSION QUESTIONS**

Begin the lesson with a few questions to stimulate discussion about lunar exploration. Answers will vary based on students' prelesson knowledge and should not be considered correct or incorrect but only to motivate discussion. Possible answers are provided for guidance.

- What have you heard or what do you know about human missions to the Moon? *There have been only 12 humans to walk on the moon from 1969–1972 during the Project Apollo missions.*
- What do you think it would be like to live the Moon? *Less gravity, no life (biosphere), atmosphere, water, or solar radiation protection.*
- What makes Earth habitable? *Atmosphere, water, solar energy, and biosphere*
- How is being on the Moon different than being on Earth? *Atmosphere, water, gravity, and biosphere*

## **ASSESSMENT ACTIVITIES**

After each task in the investigations is completed, have the Communications Officers share their team's progress with the rest of the class. Inform the students that in order to complete the next task, they may need to draw from other teams' reports. Encourage them to ask questions of other teams.

## **ENRICHMENT**

Have students determine which careers would be necessary to design, construct, and maintain a lunar habitat. They can research NASA careers at: <http://www.nasa.gov/audience/forstudents/9-12/career/index.html>

**www.nasa.gov**